Assembly Instructions MP-L Parallel Interface

Introduction

The MP-L Parallel Interface is a 5 1/4" x 3 1/2" double sided, plated thru hole board implemented with the 6820 peripherial interface adaptor integrated circuit which is used to interface a parallel data device to the computer. The board is provided with two separate connections along the top edge of the board. One has 8 fully buffered high current data outputs along with one buffered "data ready" output line and one "data accepted" input line for complete handshake control. The other has 8 fully buffered data inputs along with one "data ready" input line and one buffered "data accepted" output line for complete handshake control. The interface is completely software programmable by the user with interrupt control as well as polarity control of the handshake lines. For the user who has specialized I/O requirements, the data buffers may be removed from the board and each of the 16 data I/O lines may be individually programed for either input or output thru software in the user's program. Power for the board is supplied by a +5V voltage regulator and has a current consumption of approximately 0.3 A.

The MP-L circuit board has been hardware configured for interface applications where there is one 8 bit data input port and/or one 8 bit data output port. Each of the two ports are independent of one another and both have an extra input and output line intended for optional "handshake" use. Although the two 8 bit busses are separate, there is a TRI- STATE ® enable jumper on the output port buffers which may be disabled and driven externally allowing the two 8 bit busses to be unified into one bi-directional buss.

In special applications where you wish to configure the interface for more than 8 bits to a port, you may wish to patch the board for a different buffer arrangement or you may wish to eliminate the buffer IC's all together. In either case, it is a good idea diode protect all unbuffered, configured input lines by connecting a pair of 1N914 or similar silicon diodes (not supplied with the kit) from each input to +5 and ground. The cathode of the first diode connects to +5 and the anode of the other diode connects to ground. This provides some measure of protection for the inputs of MOS integrated circuit, IC1.

No matter if you decide to leave the input/output port buffering like it is or modify it, the control registers of the interface must be configured before the interface is used and must be compatable with its hardware buffering circuitry. Complete details on the interface's internal registers and the configuring of them is contained in the Hardware and Programming sections of the System Documentation Notebook and will not be dealt with here.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confusion during assembly. The MOS integrated circuits supplied with this kit are susceptible to static electricity damage and for this reason have been packed with their leads impressed onto a special conductive foam or possibly wrapped in a conductive foil. In either case, do not remove the protective material until specifically told to do so later in the instructions.

The MP-L parallel interface is an option board and need not be assembled nor should be installed onto the mother board until the entire computer system has been checked out and is known to be working properly.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical connection to the top foil.

(✓) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks". It is unlikely that you will find any but should there be one especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

(✓) Starting from one end of the circuit board install each of the three, 10 pin Molex female edge connectors along the lower edge of the board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the circuit board so that each pin extends completely into the holes on the circuit board. Not being careful here will cause the board to either wobble and/or be crooked when plugging it onto the mother board. It is suggested that you solder only the two end pins of each of the three connectors until all have been installed at which time if everything looksstraight and rigid you should solder the as yet unsoldered pins.

(✓) Following the procedure outlined above, attach the two remaining 12 pin Molex female edge connectors along the upper edge of the board. Solder.

(✓) Insert the small nylon indexing plugs into both the upper and lower edge connector pins indicated by the small triangular arrows on the "BOTTOM" side of the circuit board. This prevents the board and I/O connectors from being accidently plugged on incorrectly.

(✓) Attach all of the capacitors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder.

(✓) Install the diodes on the board. The diodes must be turned so the banded end corresponds with that shown on the component layout drawing.

( ) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board as is secured to the circuit board with a #4 - 40 x 1/4" screw, lockwasher and nut. A heatsink is not used. The three leads of the intergrated circuit must be bent down into each of their respective holes. Solder.

( ) After deciding which, if any of the buffer integrated circuits IC3 thru IC5 you will be using, install them on the circuit board. If you will be using the board for the normal 8 bit input/output port configuration, install IC3, IC4 and IC5. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hold the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The semi-circle notch, dot or bar on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

( ) Unless you plan to use a single 8 bit bi-directional input/output data buss with external TRI-STATE ® switching, you will want to connect the tri-state enable jumper between pads C and D located between integrated circuits IC4 and IC5 on the board. This jumper is shown installed in place in the component layout drawing.

( ) Unless you plan to use the board in a special situation where you will be using the non-maskable interrupt (NMI), you will want to run a pair of jumpers between point A and IRQ and point B and IRQ on the board. This allows you to use the conventional interrupt, request line (IRQ) when it is selected in your program. These jumpers are not shown in place on the component layout drawing.

NOTE: MOS integrated circuits are susceptable to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits. their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 M ohm 1/4 watt resistor (supplied with the kit). The ground must be an "earth" ground such as a water pipe, and not the circuit board ground, As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg ohm resistor connected between you and the "earth" ground, otherwise you will be creating a dangerous shock hazard. Avoid touching the leads of the integrated circuits any more than necessary when installing them, even if you are grounded. On those MOS IC's being soldered in place, the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg ohm resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

( ) Install MOS integrated circuit IC1 following the precautions given in the preceding section. As it is installed, make sure it is down firmly against the board before soldering all of its leads. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuit should replacement ever be necessary.

The "dot" or "notch" on the end of the package is used for orientation purposts and must match with that shown on the component layout drawing for the IC.

(3) Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability.

(2) Now that all of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

(4) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during checkout. Also look for solder "bridges" and "cold" solder joints which are another common problem.

Since the MP-L circuit board now contains a MOS device it is susceptable to damage from severe static electrical sources. One should avoid handling the board any more than necessary and when you must, avoid touching or allowing anything to come into contact with any of the conductors on the board.

Input/Output (I/O) Connector Wiring

Actual I/O connections are made thru the two 12 pin connectors along the top edge of the board. Unless the buffer integrated circuits (IC3 thru IC5) are removed or otherwise modified, one of the connectors will be used for input and the other connector will be used for output. The functions of each of the I/O connector pins are as follows:

Input Connector Pins

C1 is the "handshake" control input. It is electrically the same as the CB1 input on IC1, the PIA integrated circuit. The line is diode protected and represents one MOS load.

C2 is the "handshake" control output. It is the line buffered output of the CB2 pin on IC1, the PIA integrated circuit. It is TTL compatable and is capable of sourcing 5.2 Ma. and sinking 32 Ma. of current.

GND is the common line for all I/O connections and is electrically connected to the computer system's ground buss.

IØ-I7 are the eight non-inverting data input lines. Each is buffered and represents one standard TTL load. The buffered lines feed pins PBØ thru PB7 respectively on IC1, the PIA integrated circuit.

Output Connector Pins

C1 is the "handshake" control input. It is electrically the same as the CA1 input on IC1, the PIA integrated circuit. The line is diode protected and represents one MOS load.

C2 is the "handshake" control output. It is the line buffered output of the CA2 pin on IC1, the PIA integrated circuit. It is TTL compatable and is capable of sourcing 5.2 Ma and sinking 32 Ma of current.

GND is the common line for all I/O connectors and is electrically connected to the computer system's ground buss.

0Ø-07 are the eight non-inverting data output lines. Each is the buffered output of pins CAØ thru CA7 respectively on IC1, the PIA integrated circuit. Each line is capable of sourcing 5.2 Ma and sinking 32 Ma of current. If your system has external decoding, you may tri-state these outputs by removing the jumper between pads C and D and ungrounding the normally grounded point D for tri-state enable. This is not the normal mode of operation however.

Attaching the I/O Connector to the Interface

The male I/O connector which attach to the interface are simply a row of twelve pins supported by a nylon base. The longer side of the male connector plugs onto the interface board edge connector while the cable wires going to the peripheral device are soldered onto the shorter side of the connector. The cable which goes back to the peripheral should, if at all possible, be a multi-conductor cable (not supplied with the kit) with a minimum of twelve separate conductors.

When preparing to attach the cables to the connectors, first strip back 2" of the cable's outer insulation. While positioning each cable in line with the male connector's nylon support strip allowing the wires to extend just beyond the last pin on the strip, attach and solder each of the appropiate wires oriented so the C1 pin is connected to the shortest wire on the input connector and GND is connected to the shortest wire on the output connector. It is very easy to melt the body of the nylon connectors which will loosen the pins, so be very careful and use a heatsink on each pin between the solder point and connector body where possible. After attaching all of the cable wires bend each connector around the cable a full 180 degrees and secure with two wire ties (supplied with the kit). Now cut off the indexing pin on each male connector. To minimize noise and ringing, keep the cable length between the interface and peripheral as short as possible.

Address Assignments

Four address assignments have been allocated for each interface port; they are as follows:

PORT Ø	8ØØØ to 8ØØ3
PORT 1	8ØØ4 to 8ØØ7 (serial control interface only)
PORT 2	8ØØ8 to 8ØØB
PORT 3	8ØØC to 8ØØF
PORT 4	8Ø1Ø to 8Ø13
PORT 5	8Ø14 to 8Ø17
PORT 6	8Ø18 to 8Ø1B
PORT 7	8Ø1C to 8Ø1F

The actual addresses to be used in your programs for the interface(s) is determined by the interface position (port #) onto which the board is plugged.

Within each block of four addresses the lowest is used for Peripheral Register A and Data Direction Register A. The second sequential address is used for Control Register A. The third sequential address is used for Peripheral Register B and Data Direction Register B. The last sequential address is used for Control Register B. Complete details on these registers and their functions are contained in the Hardware section of the System Documentation Notebook and will not be repeated here.

Optional MP-L Parallel Interface Checkout Procedure

Should you have problems with the MP-L board, you may wish to check it out independent of the peripheral device to which it is connected. You may do so by running the "PARINT" diagnostic listed in the Software section of the System Documentation Notebook.

How It Works

The entire board is configured around the operation of IC1, the peripheral interface adaptor integrated circuit described in detail in the Hardware section of the System Documentation Notebook. Non-Inverting buffer integrated circuits IC3 thru IC5 simply provide the line driving and input buffering for IC1. +5 VDC power for the board is provided by voltage regulator integrated circuit, IC2.

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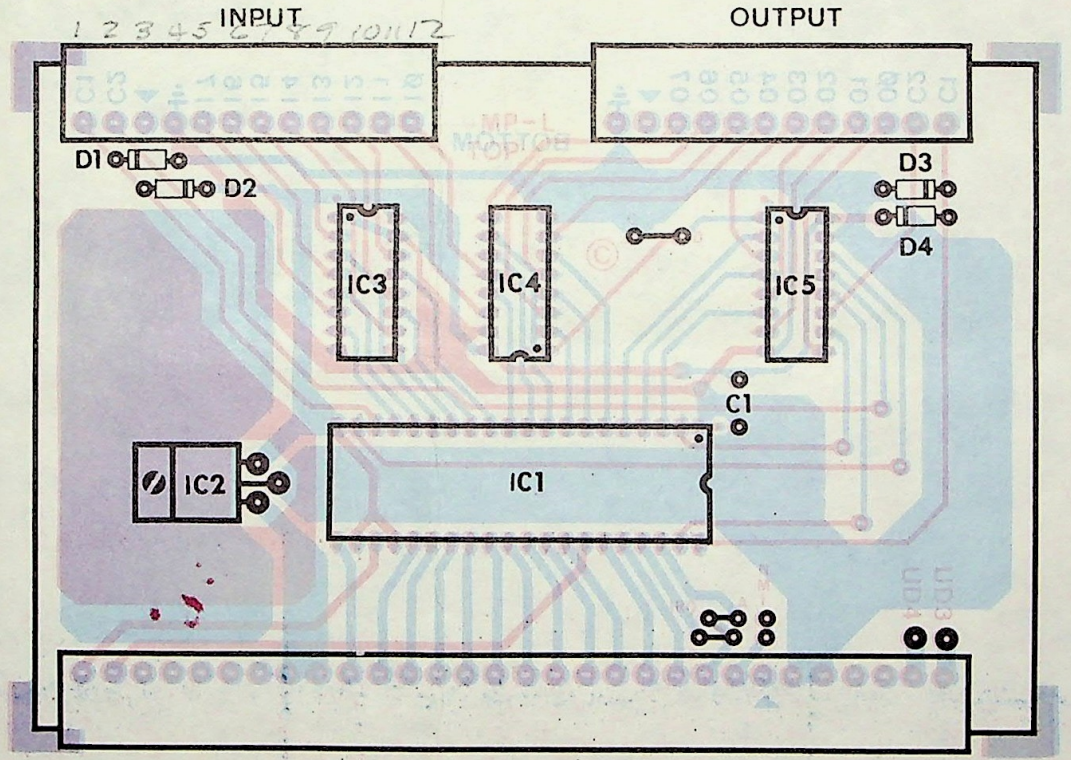
Parts List MP-L Parallel Interface

Capacitors

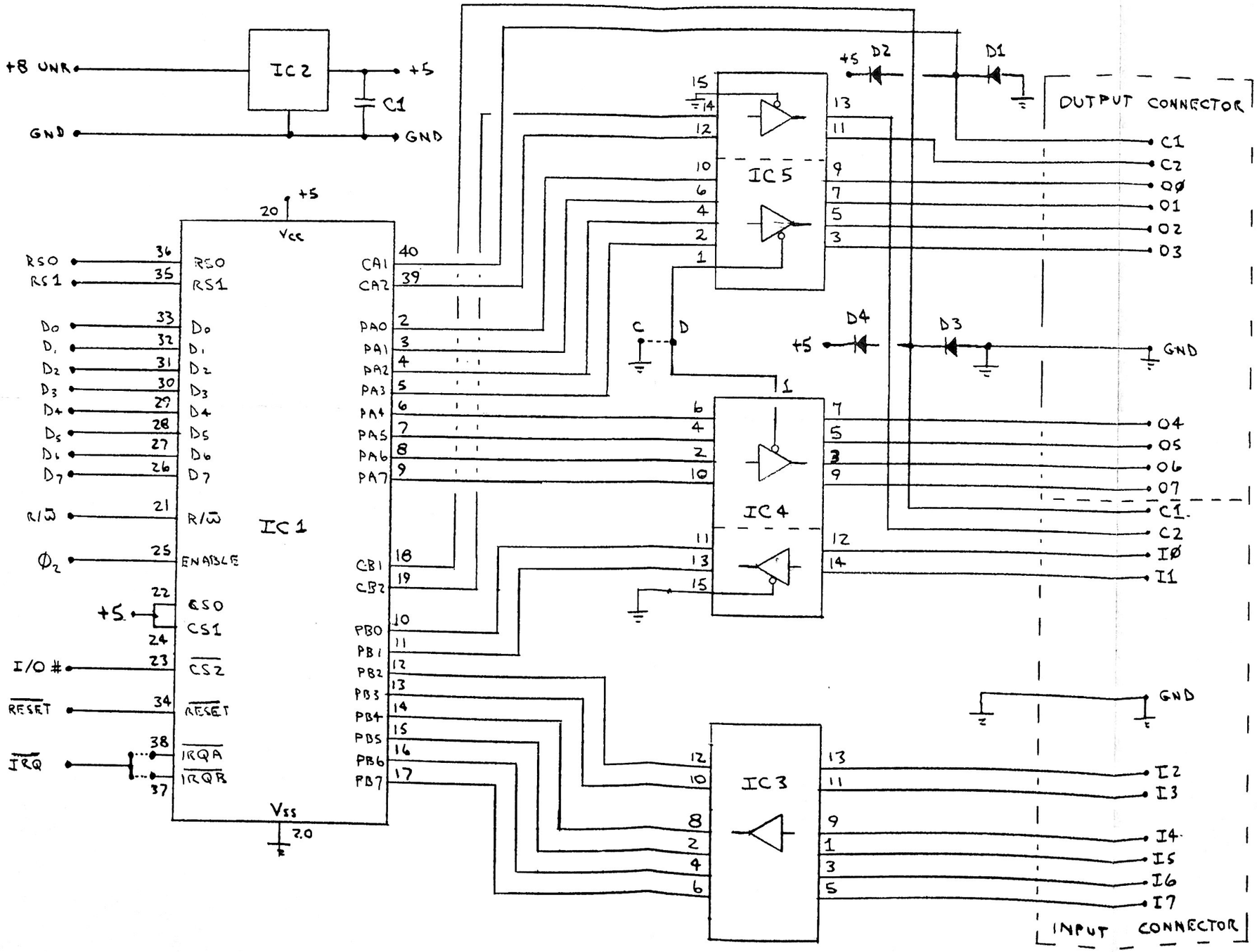
C1	0.1 mfd disc

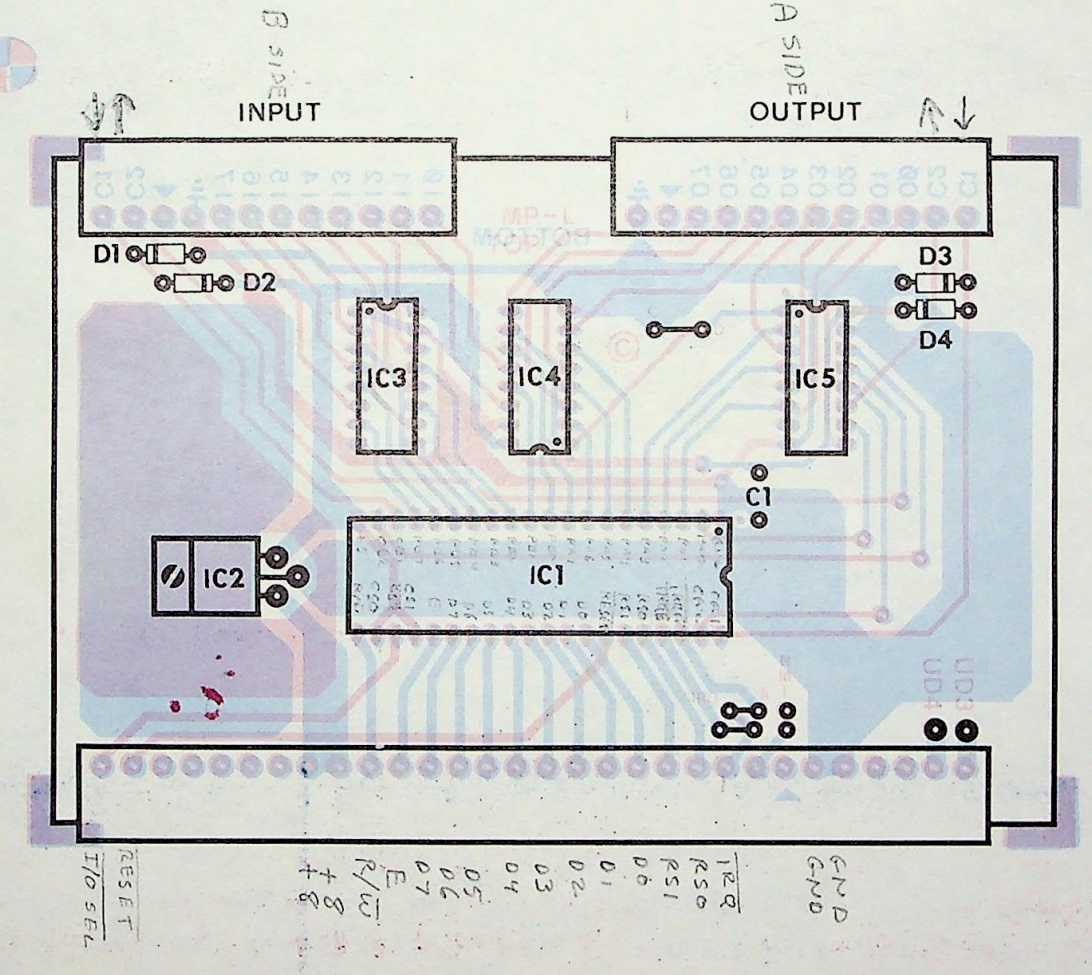
Semiconductors

D1 - D4	1N4148 or 1N914 silicon diode
IC1	MC6820 peripheral interface adaptor (MOS)
IC2	7805 5 VDC voltage regulator
IC3 - IC5	DM8097 hex TRI-STATE ® buffer


INPUT
1 2 3 4 5 6 7 8 9 10 11 12
OUTPUT
D1
D2
D3
D4
IC1
IC2
IC3
IC4
IC5
C1

Schematic - MP-L Parallel Interface




B SIDE
INPUT
A SIDE
OUTPUT
D1
D2
D3
D4
IC1
IC2
IC3
IC4
IC5
C1
RESET
I/O SEL
+8
+8
R/W
E
D7
D6
D5
D4
D3
D2
D1
D0
RS1
RS0
IRQ
GND
GND